



2017-18

4.4 Mathematical Models: Building Functions

Name _____ Date _____ Period _____

1. Let $P = (x, y)$ be a point on the graph of $y = x^2 - 8$.

a) Express the distance d from P to the point $(0, -1)$ as a function of x .

b) What is d if $x = 0$?

c) What is d if $x = -1$?

d) Use a graphing utility to graph $d = d(x)$. Sketch the graph.

e) For what values of x is d smallest?

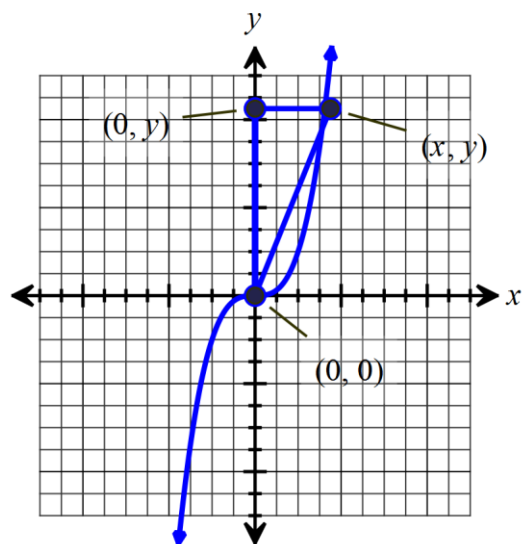
2. Let $P = (x, y)$ be a point on the graph of $y = \sqrt{x}$.

a) Express the distance d from P to the point $(1, 0)$ as a function of x .

b) Use a graphing utility to graph $d = d(x)$. Sketch the graph.

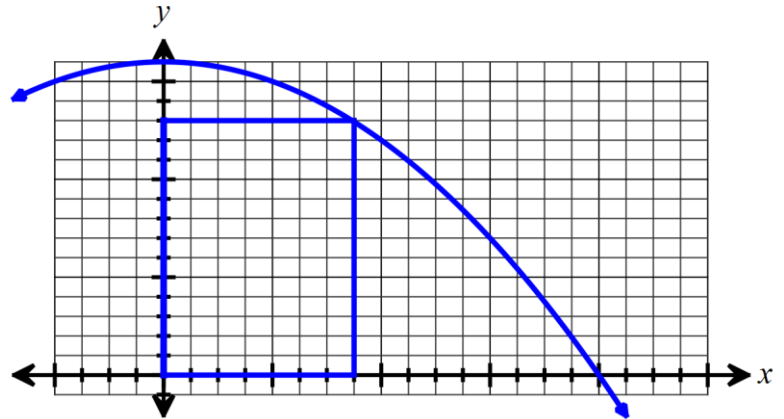
c) For what values of x is d smallest?

3. A right triangle has one vertex on the graph of $y = x^3$, $x > 0$, at (x, y) , another at the origin, and the third on the positive y -axis at $(0, y)$, as shown in the figure. Express the area A of the triangle as a function of x .



4. A rectangle has one corner in quadrant I on the graph of $y = 16 - x^2$, another at the origin, a third on the positive y -axis, and the fourth on the positive x -axis. See the figure.

a) Express the area A of the rectangle as a function of x .

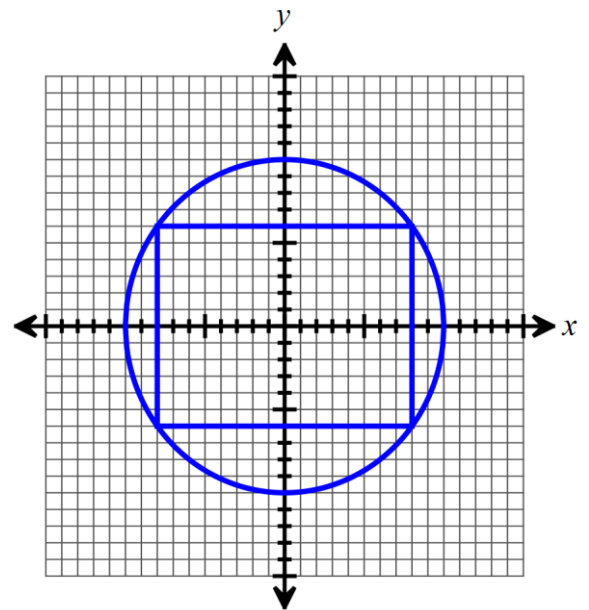


b) What is the domain of A ?

c) Graph $A = A(x)$. For which value of x is A largest?

5. A rectangle is inscribed in a circle of radius 2. See figure. Let $P = (x, y)$ be the point in quadrant I that is the vertex of the rectangle and is on the circle.

a) Express the area A of the rectangle as a function of x .



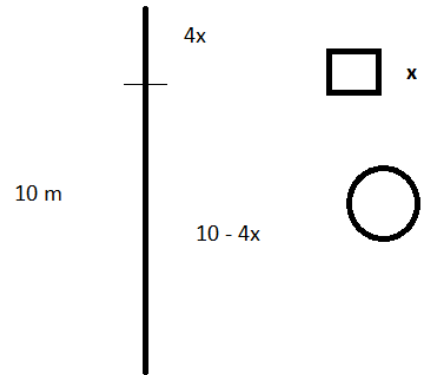
b) Express the perimeter p of the rectangle as a function of x .

c) Graph $A = A(x)$. For what value of x is A largest?

d) Graph $p = p(x)$. For what value of x is p largest?

6. A wire 10 meters long is to be cut into two pieces. One piece will be shaped as a square, and the other piece will be shaped as a circle. See figure.

- a) Express the total area A enclosed by the pieces of wire as a function of the length x of a side of the square.



- b) What is the domain of A ?
- c) Graph $A = A(x)$. For what value of x is A smallest?

7. Two cars are approaching an intersection. One is 2 miles south of the intersection and is moving at a constant speed of 30 miles per hour. At the same time, the other car is 3 miles east of the intersection and is moving at a constant speed of 40 miles per hour.

- a) Build a model that expresses the distance d between the cars as a function of time t .

(**Hint:** At $t = 0$, the cars are 2 miles south and 3 miles east of the intersection, respectively.)

- b) Use a graphing utility to graph $d = d(t)$. For what value of t is d smallest?